9. On some Fresh-water Entomostraca from Ceylon.

By Robert Gurney, M.A., F.Z.S.

[Received February 8, 1916 : Read April 4, 1916.]

(Plates I.–III.* and Text-figure 1.)

Index.

The fresh-water Entomostraca of which an account is given here were collected by Mr. G. W. Smith during a visit to Ceylon in September and October, 1907, on his return from Tasmania, and I desire to express my thanks to him for his kindness in handing them over to me for examination. The collections were made in various waters at Colombo, Kandy, Peradeniya, Mahintele, and Anuradhpura, but I have not thought it necessary in most cases to specify precisely in what spot a particular species was found.

The most complete account that has been published of the Entomostraca of Ceylon is that given by Daday in 1898; but there have been several other contributions made to our knowledge of them, so that we now know of 94 species or well-marked varieties inhabiting Ceylon. Mr. Smith's collections contain 35 species, of which three are, as I believe, hitherto undescribed, and several are additions to the list. It is rather remarkable that, of the four species of *Diaptomus* here recorded, three have not before been taken in Ceylon, and it is quite evident that the fresh-water Entomostraca of Ceylon are very far from being completely known.

I. PHYLLOPODA.

Cyclestheria hislopi Baird.

Nine specimens, some with developing young in the brood-pouch, were taken in the Colombo water-supply.

II. CLADOCERA.

Diaphanosoma excisum Sars.

A considerable number of specimens of a species of *Diaphanosoma* were found in a tank at Kandy by Lady Horton's Drive and also in Colombo Lake, while a few were taken at Anuradhpura.

* For explanation of the Plates see p. 343.

All belong to the same species, and that, in my opinion, is *D. excisum*, since they agree in all essential respects with Sars's description, though somewhat smaller than the size given by him. It is remarkable that the only species of *Diaphanosoma* recorded from Ceylon is *D. singalensis* Daday, which was found by Apstein to be common in the Colombo Lake from January to September. All the specimens that I have examined have the ventral shell-margin markedly reflexed, and cannot possibly be referred to *D. singalensis*. It is possible that there is a seasonal alternation of the two forms.

Daphnia lumholtzi Sars.

A few young specimens were taken in a tank at Kandy.

Ceriodaphnia rigaudi Richard.

Peradeniya pond; Colombo Lake; Mahintele; Anuradhpura; Kandy tank.

Ceriodaphnia cornuta Sars.

Kandy, in a pond by Lady Horton's Drive and in the tank.

Daday (1898) has expressed, and still maintains, the opinion that *C. cornuta* and *C. rigaudi* are merely extreme forms of one species, and a careful examination of the specimens at my disposal gives much support to such a view. The presence or absence of a head-spine is, in my specimens, usually correlated with the possession of a posterior shell-spine, which is slightly bifurcated or simple respectively; but not only do both *rigaudi* and *cornuta* forms occur together in the same collections, but also individuals are found which it is almost impossible to assign to one or the other. The head-spine may be so small as to be detected with great difficulty, and the shell-spine may show but the faintest trace of bifurcation. It appears to me that the *rigaudi* form may occur alone, but that wherever (in Ceylon) *C. cornuta* occurs, there also are found a small number of individuals which, in the lack of its distinctive characters, approach *C. rigaudi*. One may conclude that the species may be in fact distinct, but that *C. cornuta* is very variable and may approach *C. rigaudi* in appearance. The *cornuta* form described by Stingelin from Java, and having a double head-spine, must be regarded as merely a variety of the species, since Daday (1910) has found specimens with double head-spines together with others of the typical form in Victoria Nyanza.

Moina dubia Richard.

Kandy; Mahintele; Anuradhpura. Common.

I take this opportunity of correcting an error in my figure of this species recently published (1911, pl. ii. fig. 1). In this figure the reticulations of the ephippium are shown strongly marked over the egg-space, whereas, though a very faint reticulation can sometimes be detected, the egg-space usually appears quite

unmarked. These faint markings were shown in my drawing and have become accentuated in the plate.

MACROTHRIX ODIOSA Gurney.

Peradeniya pond. Abundant in a plankton collection taken at night, but much less common in plankton and in weeds during the day. Also taken at Anuradhpura.

The species bears some resemblance to *M. singalensis*, but differs from it in the form of the upper lip, the arrangement of cilia, and teeth on the antenna and on the post-abdomen. While the adult differs considerably from *M. triserialis* in the shape of the valves, the young closely resemble it, being of a pointed pear-shaped form.

MACROTHRIX TRISERIALIS Brady.

Mahintele—Snake's pool. Two specimens only seen.

LEYDIGIA AUSTRALIS Sars.

In a tank at Anuradhpura great numbers of cast shells of a species of *Leydigia* were taken, and among these there are two or three post-abdomina, but none with the terminal claw attached. However, the shape of the post-abdomen and the arrangement of the spines, together with the fact that the shell-valves are not striated, make it certain that the species is *L. australis*. The arrangement of the spines is distinctive in this species; there is a regular series, decreasing in size anteriorly, of groups containing one long spine and two very short ones, and these groups are not replaced by groups of cilia till the anal depression is reached.

At Mahintele a single specimen of a *Leydigia* was taken which agrees most closely with *L. australis* var. *ceylonica* Daday. In this specimen the spines of the post-abdomen are more slender and partly arranged in fours (Pl. I. fig. 1), and the shape of the post-abdomen recalls that of *L. propinqua*. My specimen, which is much decayed, differs from Daday's form in absence of sculpture on the shell.

ALONA RECTANGULA Sars.

A few specimens of a small form of this species were taken in Peradeniya pond. Some females are ephippial, but no males were seen. In some specimens the upper lip has a minute tooth on its anterior margin.

ALONA INTERMEDIA Sars.

Old tank at Anuradhpura.

ALONELLA DAVIDI Richard.

One specimen and a moulted shell were included in a collection from the old tank at Anuradhpura. They agree exactly with regard to form of post-abdomen and arrangement of spines and

cilia with the specimens described by Stingelin (1904) from Java and Honolulu, except that here the claws have no cilia. But in my specimens the shell is distinctly striated, but without reticulations, thus approaching more nearly to Richard's description.

I have already (1911) given reasons for regarding *A. davidi* and *A. punctata* Daday as varieties of *A. diaphana* King, but I am inclined to think that, though I still believe the three species to form a gradational series, yet it is perhaps more convenient and less cumbrous to leave the three names to define the three varieties.

Alonella karua King.

Peradeniya and Anuradhpura.

Alonella excisa Fischer.

Peradeniya pond.

Chydorus parvus Daday. (Pl. I. figs. 2, 3.)

Peradeniya pond and Priest's Well; Kandy; Anuradhpura.

In 1898 Daday described, under the name of *C. sphæricus* var. *parvus*, a *Chydorus* from Colombo Lake, differing chiefly from *C. sphæricus* in the form of the upper lip (fig. 2), and I have little hesitation in referring to this species a *Chydorus* which is common in some of Mr. Smith's collections. These specimens, which vary from ·28 to ·35 mm. in length, are nearly globular in shape and usually of an opaque golden-yellow colour. In the form of the upper lip and of the post-abdomen (fig. 3) they agree very closely with Daday's description, but they differ in the fact that I have been unable to detect with certainty any sculpture on the shell, whereas Daday's species shows strong reticulation.

Chydorus barroisi Richard. (Pl. I. figs. 4, 5.)

Peradeniya pond; Anuradhpura.

My specimens unite in a very perplexing way the characters of *C. barroisi* and *C. poppei* Richard. All my specimens agree in having the upper lip strongly serrated and in the arrangement of spines on the post-abdomen (fig. 5), and nearly all have the shell-valves smooth. The majority have also a tooth at the posterior ventral angle of the shell (fig. 4) and an additional minute spine at the base of the caudal claws, but I have also seen specimens which lack the one or the other. In the structure of the post-abdomen they agree much more closely with *C. poppei* than with *C. barroisi*. *C. hybridus* Daday unites in the same way the characters of the two species, and it seems to me that the three are not, in fact, specifically distinguishable. *C. poppei* has been recorded only from South America and from the Southern United States, but *C. barroisi* occurs in Syria, Ceylon, various parts of Malaysia, New Zealand, East Africa, and South America. Stingelin (1913) also expresses the opinion that the three above-named species should probably be united into one.

III. COPEPODA.

Cyclops distinctus Richard. (Pl. I. fig. 6.).

In a collection from a pond by Lady Horton's Drive at Kandy a few specimens of a *Cyclops* were found, which I assign with some hesitation to this species. The specimens included only a single adult female, the rest being chiefly adult males.

My specimens differ in some important respects from typical European specimens with which I have compared them :—

(1) In size. Length : ♀, 1·44 mm. ; ♂, ·95 mm. Whereas English specimens measure about 2 mm. (♀).

(2) Furcal rami. Whereas in typical *C. distinctus* the rami are about $2\frac{1}{2}$ times longer than they are broad, in specimens from Kandy they are less than twice the breadth. Also in the latter the lateral seta is very long—longer than the ramus. The proportional length of the remaining setæ is the same in both.

Since in other respects—as, for example, in the form of the fourth pair of legs and their uniting lamella (fig. 6)—the agreement is complete, I do not think the differences are sufficient to constitute a distinct species.

Cyclops hyalinus Rehberg.

Kandy ; Mahintele ; Anuradhpura.

Cyclops leuckarti Claus.

Peradeniya ; Kandy ; Anuradhpura.

Cyclops varicans Sars.

Peradeniya ; Kandy ; Anuradhpura. Rare.

Cyclops varius Lillj., var. proximus Lillj.

A few specimens taken in the Priest's Well at Peradeniya.

Cyclops prasinus Fischer.

Peradeniya—Priest's Well ; Kandy—Lady Horton's Drive pond.

Canthocamptus grandidieri Guerne & Richard, var. (Pls. I. & II. figs. 7–9.)

In collections from Peradeniya and from Anuradhpura a few specimens of a species of *Canthocamptus* were found which I find difficulty in identifying. In most respects they agree very closely with descriptions given of *C. grandidieri*, but with regard to the furca and to certain details of the fifth pair of legs there are differences which are constant and considerable. The furcal rami are more or less quadrangular, bearing at their apex a short slender seta on the inner angle and a single very long seta with

a rather swollen base (fig. 7); but in place of the usual external long seta there is, in all adults, merely a small finger-like outgrowth. On the other hand, in all immature specimens two setæ are present of the usual form. A further difference is that the ramus is not, as is usual in *C. grandidieri*, distinctly produced dorsally. There is indeed a slight overhang, but it is scarcely noticeable (fig. 9). With regard to the fifth pair of legs the agreement is closer, but here the innermost spine of the basal joint is very much shorter than the others, and the second joint is smooth on its inner face (fig. 8). In the proportional length of the spines on this leg my specimens agree more nearly with *C. laciniatus* Van Douwe, which itself seems to me only a variety of *C. grandidieri*. Brady's description of *C. cingalensis* is too incomplete to make any satisfactory comparison possible.

Diaptomus doriai Richard.

Anuradhpura. Rare.

Diaptomus strigilipes Gurney.

Anuradhpura—Baltring tank; Mahintele. Abundant.

Diaptomus annæ Apstein. (Pl. II. fig. 10.)

Peradeniya pond; Kandy; Colombo Lake.

Brehm has found that specimens from Kandy do not agree in all respects with the description given by Apstein, the third joint of the exopodite of the fifth foot in the female being clearly distinct, and argues that the separation or fusion of this joint is therefore not of great systematic importance. In all my specimens this joint is separate, and Apstein has found that it is, in fact, distinct in his original specimens. The endopodite of this leg in my specimens, as in Brehm's, is considerably shorter than the first joint of the exopodite, and, in respect of length, this joint seems to be very variable. I have seen one specimen (fig. 10) in which this branch was clearly two-jointed, but this is evidently an abnormality.

Diaptomus viduus, sp. n. (Pl. II. figs. 11–14.)

In a collection from the Snake's pool at Mahintele, among large numbers of *D. strigilipes*, a single male *Diaptomus* was found which appears to belong to an undescribed species. In spite of very careful search I have found only the single specimen, but it seems to me so distinct that it is best to describe and name it.

The body is slender and tapering anteriorly; last segment of the thorax with pronounced posterior angles bearing two small spines on either side (fig. 11). Fourth abdominal segment asymmetrical, being slightly swollen on the right side. Furcal rami and setæ of normal shape. The left antenna reaches, when reflexed, to the end of the fourth abdominal segment. The

antepenultimate joint of the right antenna has a hyaline membrane and a short outwardly-turned hook (fig. 12). The fifth leg (fig. 13) on the right side has two small hyaline processes on the second basal joint; the endopodite is longer than the first joint of the exopodite. The first joint of the exopodite is produced laterally into a pointed process and bears on its posterior face a large hyaline process (fig. 14). The second joint of the exopodite has the spine, which is usually lateral and distal in position, inserted on the posterior face near the base of the joint.

Length 1·75 mm.

IV. OSTRACODA.

Notodromas oculata Sars. (Pl. III. fig. 15.)

Tank by Lady Horton's Drive.

This species differs very little from *N. entzi* Daday, being somewhat smaller and with different markings. In dorsal view it is seen that *N. entzi* is much wider behind than in front, whereas in *N. oculata* the outline is an almost regular oval (fig. 15).

Strandesia (Cypris) vittata Sars.

Common in Peradeniya pond.

My specimens agree in all respects with Sars's description, with the exception that they do not show the coloured bands mentioned by him, the absence of which is possibly due to the preservative. The curious "lop-sided" appearance in end view is very characteristic. Previously recorded from Puching, China.

Eurycypris subglobosa Sowerby.

Colombo Lake. Rare.

Stenocypris malcolmsoni Brady.

Colombo Lake.

Cypricercus reticulatus Daday ?

A considerable number of specimens of a species of *Cypricercus* were taken in Peradeniya pond. Unfortunately all appear to be immature, not exceeding ·7 mm. in length and with the ovary barely distinguishable. My specimens differ somewhat from *C. reticulatus* in shape and also in the complete absence of any shell-sculpture, but I cannot assign them to any other species nor safely describe them as new.

Cypridopsis newtoni Brady & Robertson. (Pl. III. fig. 16.)

Syn. *C. aldabræ* Müller.

Great quantities of this species were found in Colombo Lake and a few specimens at Mahintele. Apstein has recorded *Candonella albida* Vavra from Colombo Lake, but I have found no

specimens which can be referred to that species. On the other hand, the shape of the shell (fig. 16) points unmistakably to the closely allied species *C. aldabræ*, with which my specimens agree also in other respects. Unfortunately I have not been able to find a single male, so that the comparison is incomplete.

Oncocypris pustulosa, sp. n. (Pl. III. figs. 17–21.)

Seen from above the animal is pear-shaped, very broad behind and tapering anteriorly, with a constriction in front of the eye (fig. 17). In quite young individuals the shape is that of an egg, with the greatest width just behind the middle and tapering evenly in front and behind. Seen from the side the two valves are alike, kidney-shaped, broader in front than behind (fig. 18). The cuticular border is broad anteriorly, scarcely visible ventrally, and narrow behind. Seen from inside, the structure of the shell is distinctive. In the left valve the anterior cuticular border is very broad and springs from the edge of the shell, its point of origin being marked by the accompanying setæ. Beyond this point is the "pore-canal" zone, in which are seen a series of strongly marked semicircular loops which appear to indicate unbranched pore-canals, but their real nature is not at all clear (fig. 19). Cutting across them is seen a conspicuous ridge. The structure is much the same posteriorly and in the right shell.

The surface of the shell is thickly covered with little knobs, but in very young specimens it is strongly reticulated and pitted. The eyes are very large and united. The general colour, in spirit, is golden yellow with a conspicuous greenish pigment-spot on either side of the eye.

The maxilla has no respiratory plate, but in place of it there is a single small seta. Müller gives the entire absence of setæ as an important character of the genus, and it is possible that the specimen in which I have seen the seta is abnormal in this respect. From the small number of specimens at my disposal I am unable to go further into the matter. In the second maxilla there are two strong spines on the third lobe, one of which is toothed and the other smooth. In the first leg the third and fourth joints are fused; the last joint bears a very large curved spine and a single short seta (fig. 20). The second leg has a well-developed terminal joint bearing a long curved claw, a seta of about the same length, and a small hair (fig. 21). The furca is a simple flagellum.

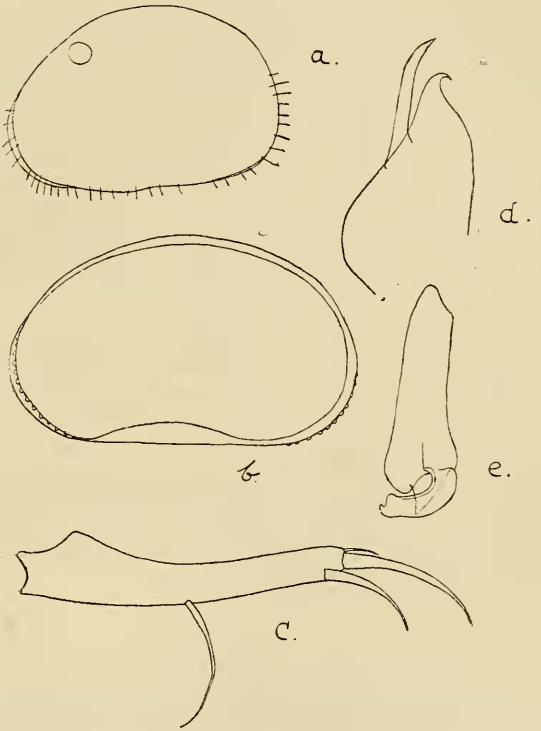
Length ·5–·58 mm.; width ·43–·54 mm.; height ·3–·38 mm.

A very few female specimens of this species were taken in a tank by Lady Horton's Drive at Kandy. The genus *Oncocypris* was established by G. W. Müller for a species, *O. voeltzkowi*, from Madagascar, which has since been found also in Abyssinia (Daday) and South Africa (Brady). The only other species of the genus is *O. costata* Daday from German East Africa. It is therefore of considerable interest to find that a species of this African genus occurs also in Ceylon.

Physocypria tuberata, sp. n. (Pl. III. fig. 22 ; text-fig. 1.)

Female. Seen laterally the shell is oval, the greatest height equal to two-thirds the length and falling behind the middle (text-fig. 1 *a*). The anterior end is much less broad than the posterior end. The right and left shells are of the same shape, the left shell slightly the larger and overlapping the right in front. Both shells have a narrow hyaline border and are fringed

Text-figure 1.



Physocypria tuberata.

a. Female. Left valve, × 66.
b. Male. Right valve from inside, × 126.
c. Female. Furcal ramus, × 274.
d. Male. Copulatory organ, × 274.
e. „ Clasping organ of right side, × 274.

with long scattered setæ. The right shell differs from the left in having a row of small knobs on the anterior and posterior margins (text-fig. 1 *b*). Seen from above the shell is much compressed and narrower in front than behind (Pl. III. fig. 22). The surface of the shell is smooth, but marked with small brown

spots. In the second leg the penultimate joint is three and a half times as long as the last joint and without cilia. The last joint bears two subequal claws and a recurved seta longer than the last three joints of the leg. The furcal rami are slightly curved and bear two short stout claws and a very short seta at the apex. The dorsal seta is inserted about the middle, and is nearly half as long as the furca and about the same length as the longest claw (text-fig. 1 *c*). Length ·45–·5 mm.; height ·27–·28 mm.

Male. The male differs somewhat from the female, the dorsal margin of the shell being more flattened and the two ends more equally rounded. The tubercles of the right shell are conspicuous. The palp of the right second maxilla is slender, broader at the end, and with a triangular pointed process (text-fig. 1 *e*); the last joint is in the form of a curved blunt-ended claw. The palp of the left side is more or less cylindrical, not dilated at the end, and with a minute tooth in place of the triangular process of the right side. The distal joint forms a curved sharp-pointed claw. The copulatory apparatus consists of a large triangular lamella with pointed recurved end, and a narrow pointed process hinged to it (text-fig. 1 *d*). The ejaculatory apparatus has six rings of spines.

A few specimens only of this species were found in a collection from Colombo Lake, and amongst them was a single male.

The species resembles *Cypria crenulata* Sars very closely, and, indeed, may be but a variety of it, but it differs from it in having knobs on both the anterior and posterior margins of the right shell, and also in the presence of brown spots on the shell. Sars gives no particulars of the structure of the male by which a comparison could be made, but he says that the male is exactly like the female in shape, and that is not quite the case with regard to my own specimens.

Literature.

Apstein, C.—"Das Plankton im Colombo-See auf Ceylon." Zool. Jahrb., Abt. Syst. xxv. 1907, pp. 201–244.

Apstein, C.—"Das Plankton des Gregory-Sees auf Ceylon." Zool. Jahrb., Abt. Syst. xxix. 1910, pp. 661–680.

Brady, G. S.—"Notes on Entomostraca collected by Mr. Haly in Ceylon." Journ. Linn. Soc., Zool. xix. 1886, p. 293.

Brehm, V.—"Ueber die Mikrofauna chinesischer und südasiatischer Süsswasserbecken." Arch. f. Hydrobiol. u. Planktonk. iv. 1909, pp. 207–224.

Daday, E. von.—"Mikroskopische Süsswasserthiere aus Ceylon." Termés. Füzetek, Anhangsheft zum xxi. Bd. 1898.

Daday, E. von.—"Untersuchungen über die Süsswasser-Mikrofauna Deutsch-Ost-Afrikas." Zoologica, Bd. xxiii. Heft 59, 1910.

GURNEY, R.—"On Two new Entomostraca from Ceylon." Spolia Zeylanica, iv. 1907, pp. 126–134.

GURNEY, R.—"On some Fresh-water Entomostraca from Egypt and the Soudan." Ann. & Mag. Nat. Hist. (8) vii. 1911, p. 25.

POPPE, S. A., and MRÁZEK, A.—"Die von Herrn Dr. H. Driesch auf Ceylon gesammelten Süsswasser-Entomostraken." Beih. zum Jahrb. d. Hamb. Wiss. Anst. xii. 1895.

STINGELIN, TH.—"Untersuchungen über der Cladoceren-fauna von Hinterindien, Sumatra und Java." Zool. Jahrb., Abt. Syst. xxi. 1904, pp. 327–370.

STINGELIN, TH.—"Voyage d'Exploration Scientifique en Colombie." Cladocera. Mém. Soc. Neuch. Sc. nat. v. 1913.

EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1. *Leydigia australis* var. *ceylonica*. Post-abdomen. × 260.
2. *Chydorus parvus*. Upper lip. × 445.
3. „ „ Post-abdomen. × 1050.
4. „ *barroisi*. Female. × 260.
5. „ „ Post-abdomen. × 1050.
6. *Cyclops distinctus*. Uniting lamella of fourth pair of legs of male. × 445.
7. *Canthocamptus grandidieri*. Furcal rami. × 445.
8. „ „ Fifth leg of female. × 445.

PLATE II.

Fig. 9. *Canthocamptus grandidieri*. Furcal ramus, side view. × 445.
10. *Diaptomus annæ*. Fifth leg of female showing (abnormal) 2-jointed endopodite. × 445.
11. „ *viduus*, sp. n. Male. × 58.
12. „ „ „ Prehensile antenna. × 120.
13. „ „ „ Fifth pair of legs. × 120.
14. „ „ „ Part of the right leg of the fifth pair. × 320.

PLATE III.

Fig. 15. *Notodromas oculata*. Dorsal view of female. × 98.
16. *Cypridopsis newtoni*. Right valve of female. × 120.
17. *Oncocypris pustulosa*, sp. n. Dorsal view of moulted shell. × 150.
18. „ „ „ Side view. × 98.
19. „ „ „ Anterior end of left valve from inside. × 260.
20. „ „ „ First leg. × 445.
21. „ „ „ Second leg. × 445.
22. *Physocypria tuberata*, sp. n. Dorsal view of female. × 98.